

## ON THE BRITISH SPECIES OF SIMULIUM.—I. THE ADULTS.

By F. W. EDWARDS.

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The theories at present widely accepted regarding the connection between the SIMULIIDAE and pellagra have brought this family of blood-sucking flies very much to the front in recent years, and have rendered it highly desirable that accurate information should be available concerning the different species, their distribution and habits. It is in the hope that the facts brought forward may be of use at some future time, and that the way may be cleared for further research, that the present investigation has been undertaken. The writer has examined over 1,000 pinned specimens, including the material in the British Museum, the Cambridge Museum and the Edinburgh Museum, together with a large number of additional specimens kindly lent by various private correspondents. The result of this examination will, it is believed, go some way towards an elucidation of the European species of this family.

No exact work has ever been published upon the British species, and although a large number of names have been applied to European forms, the descriptions are for the most part unrecognisable. Recently, however, Dr. C. Lundström has given us an account of the Finnish species.\* In this paper for the first time some attention is paid to the male genitalia, and a number of figures of these organs are given. Lundström, however, has not studied them sufficiently closely, and does not mention other equally important characters, such as the female claws. Another very valuable paper is that published last year by J. R. Malloch on the American species.† This, however, has one serious fault, in that it ignores genital characters. The present writer is largely indebted to both these papers for suggestions as to the classification and description of the British species. For reasons which will be given later, however, it has not been thought advisable to follow Malloch and Roubaud in subdividing the genus *Simulium*.

The writer is indebted to the following gentlemen for the loan of specimens (the initials in brackets after the collectors' names are those used in the subsequent part of this paper): Messrs. E. A. Atmore (A.); A. E. J. Carter (Ct.); J. W. Carr (Cr.); J. E. Collin (C.); P. H. Grimshaw (G.); A. H. Hamm (H.); F. Jenkinson (J.); J. J. F. X. King (K.); C. G. Lamb (L.); C. Morley (M.); Lt.-Col. C. G. Nurse (N.). In addition the following collectors, among others, have presented specimens to the British Museum: Messrs. F. W. Edwards (E.); A. Piffard (P.); G. H. Verrall (V.); Lt.-Col. J. W. Yerbury (Y.).

## GENERAL MORPHOLOGY.

It is not the purpose of this paper to give a full account of the adult structure in *Simulium*, but attention may be called to a few points which have either been in dispute or have not been previously noted.

\* 'Beiträge zur Kenntnis der Dipteren Finlands. vii Melusinidae (Simuliidae).' Acta societatis pro Fauna et Flora Fennica, xxxiv, no. 12, 1911.

† U.S. Dept. of Agric., Bureau of Ent., Technical Ser. no. 26. 'American Black Flies or Buffalo Gnats.'

*Antennae*.—These have been variously stated to be 10- or 11-jointed, Brunetti even as late as 1913 claiming that only 10 joints are present. All the species which I have examined, however, agree with Meigen's description in having 11-jointed antennae.

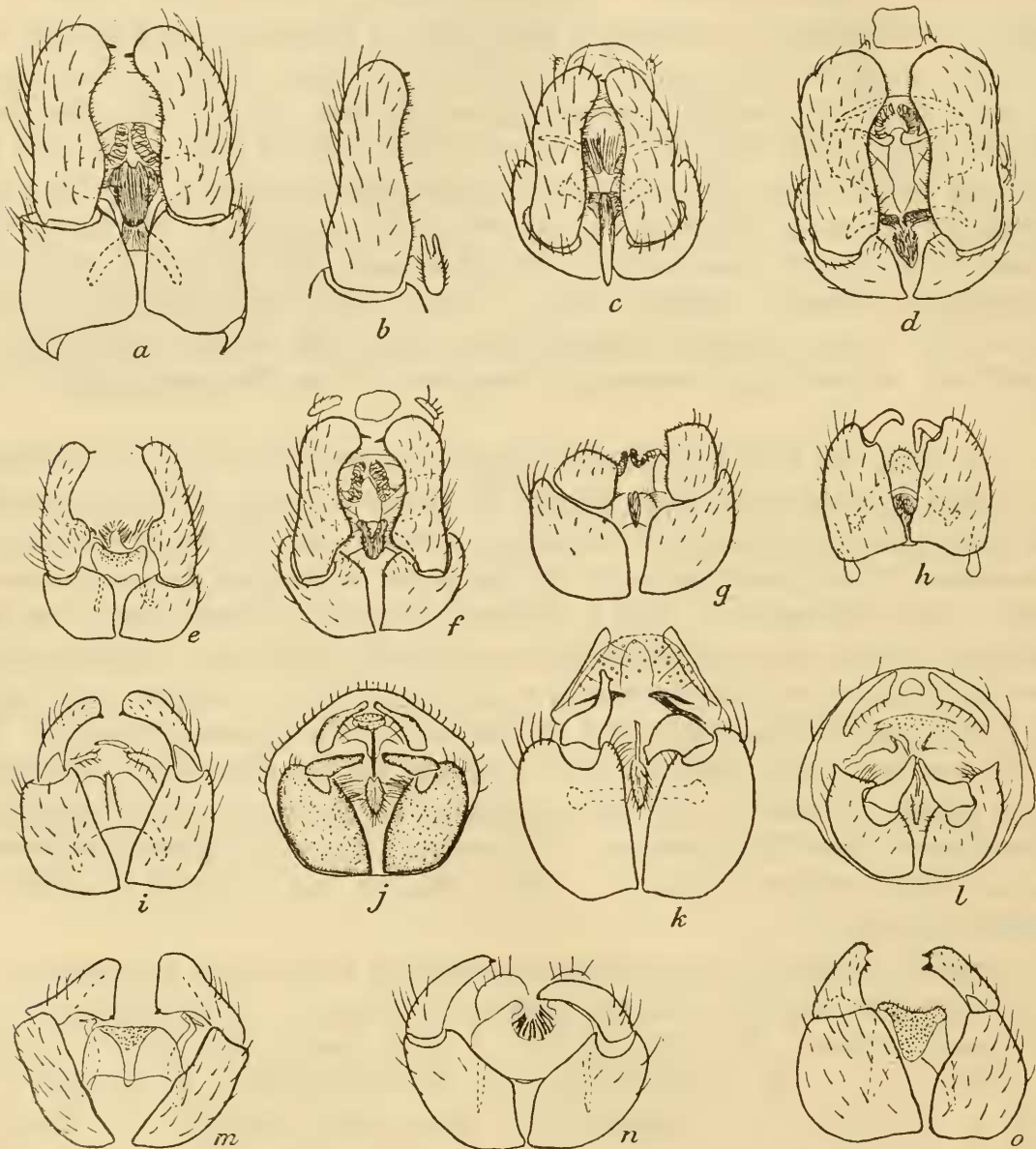


Fig. 1. Male genitalia of British *Simulium*, as seen from beneath, all  $\times 75$ , (except in figs. *j* and *l* the ninth tergite has been removed):—*a*, *S. ornatum*; *b*, *S. variegatum*, clasper and external part of adminiculum; *c*, *S. reptans*; *d*, *S. morsitans*; *e*, *S. tuberosum*; *f*, *S. austeni*; *g*, *S. argyreatum*; *h*, *S. equinum*; *i*, *S. aureum*; *j*, *S. angustipes*, a specimen from Wells, Som.; *k*, the same, from Sligo; *l*, the same, in a different position, from Nairn; *m*, *S. latipes*; *n*, *S. subexcisum*; *o*, *S. hirtipes*.

In figs. *c*, *d*, *f*, *i*, *j*, *k*, *l* and *n* the *appendices superae* are shown, but in the rest they have been removed with the ninth tergite.

*Mouth-parts*.—These have never been very accurately described, the best description still being that of Meinert in his well-known paper on the mouth-parts of Diptera. It has sometimes been stated that in *Simulium* the mouth-parts of the male are

much less developed than those of the female, the mandibles being absent in the former sex. This is not the case; the male *Simulium* of several species examined microscopically by the writer had both mandibles and maxillae fully developed, and these organs only differed from those of the female in being somewhat more pointed and in having only fine hairs instead of sharp teeth along their margins; besides this, the labium has more numerous sensory papillae in the male than in the female. Lt.-Col. Alcock, in his recent book, *Entomology for Medical Officers*, states that the mandibles of the female are toothed on the inner edge, the maxillae on the outer. This is indeed the appearance under a low magnification, but if a sufficiently high power be used, it can be seen that both mandibles and maxillae are toothed along both edges. No specific differences were observable in the mouth-parts.

Alcock has called attention to the well-marked sensory vesicle in the second joint of the palpi. So far as I am aware this is the only reference to this organ in the literature of the Diptera, but I believe its study in this and related families of flies might yield valuable results from the point of view of phylogeny. I have noticed a very similar structure in MYCETOPHILIDAE, and (in a reduced form) in certain BLEPHAROCERIDAE.

*Abdominal scale.*—The peculiar structure characteristic of this family, situated at the base of the abdomen and clothed with long hair, has sometimes been regarded as belonging to the abdomen and sometimes to the thorax. After having made careful dissections of cleared specimens, I am convinced that it represents the first abdominal tergite. It is more or less completely divided into a large dorsal and two smaller lateral pieces, and seems to be in some way connected with a very large internal development of the hind coxae.

*Male genitalia.*—These have been described by Lundström, but it is perhaps advisable to give a short redescription to explain the terms used. As in other Diptera, the genitalia are extremely important for specific distinctions. The ninth tergite (*lamella terminalis*) is well developed and entirely covers the other organs, which in the dry specimen can therefore only be seen from the ventral side. It has attached to its posterior margin three small chitinous pieces, of which the two lateral ones (*appendices superae* or *oberen Anhänge*) are more or less hairy. These appendages undoubtedly exhibit useful specific characters, but I have not paid much attention to them, as, in order to facilitate the examination and drawing of the more important ventral parts, I have usually dissected away the ninth tergite with the *appendices superae* attached. The most important parts are the large side-pieces (*appendices intermediae* or *Zänge*) together with the claspers which are articulated to them. Owing to the absence of the ninth sternite, these organs have taken up a more ventral position than usual in the Nematocera; their structure can usually be made out without dissection even in a dry specimen. Between the ninth tergite and the side-pieces, and more or less completely hidden by them, is the adminiculum, with its appendages (*Arme* and *Griffel*). This organ, though subject apparently to some amount of individual variation, provides one of the means of separating certain closely allied species.

*Tarsi.*—Important specific characters are to be found in the thickness and relative lengths of the joints of the front tarsi in both sexes, and of the hind tarsi of the



male, though I believe that here again there is a certain amount of individual variation. The female claws also yield important characters, though, like Malloch, I have been unable to discover any differences in the male claws.

So far as I am aware, no previous writer has noted the well-marked pulvilliform margin of the fourth tarsal joint (see fig. 4, *a*, etc.) which seems to have been developed instead of true pulvilli, of which I have not been able to find any trace. This condition of the fourth tarsal joint is found in both sexes and all species.

The second hind tarsal joint of nearly all species, as pointed out by Roubaud and figured by Malloch and others, has a distinct dorsal excision near the base (fig. 6, *a*). For the species in which this excision is not found (represented in Britain by *S. hirtipes*, fig. 6*b*) Roubaud proposed the subgenus *Prosimulium*, and Malloch has adopted this name in a generic sense. The latter writer has also called attention to the possession of an additional vein in the wings by most species of *Prosimulium* (e.g., *S. hirtipes*, fig. 5, *b*). But as intermediates are found with regard to both these characters (e.g., *S. meridionale* and *S. subexcisum* in respect of the tarsi, and *S. mutatum* and *S. pecuarum* in respect of the wings), and as other characters (e.g. the female claws) do not support the division, I have considered it inadvisable at present to make any use of the term *Prosimulium*, and prefer to regard all the species as constituting a single genus. A more natural division of the genus, at least so far as the British species are concerned, seems to be the one adopted in this paper.

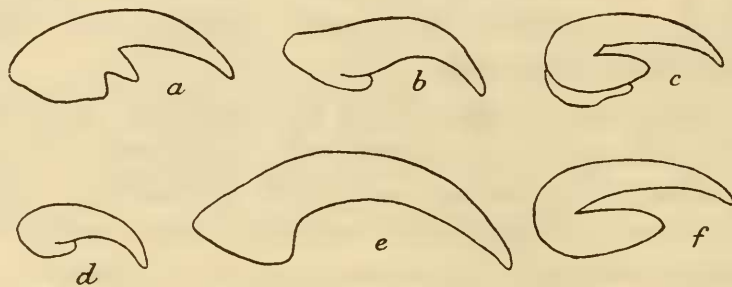


Fig. 2. Female claws of *Simulium*,  $\times 325$ :  
*a*, *S. ornatum*; *b*, *S. argyreatum*; *c*, *S. latipes*;  
*d*, *S. tuberosum*; *e*, *S. equinum*; *f*, *S. subexcisum*.

#### BLOOD-SUCKING HABITS.

It would appear to be the case that not all the species are addicted to blood-sucking habits, notwithstanding the fact, already alluded to, that the mouth-parts are equally developed in the females of all the species. Our two commonest species, *S. ornatum* and *S. latipes*, have never, so far as I am aware, been recorded as biting either man or other animals; while Dr. A. Lutz, whose admirable work on Brazilian biting flies is well known, made some observations on the habits of *S. ornatum* in the neighbourhood of Bath last summer, and formed the opinion that it never does bite. On the other hand, *S. reptans* and its near allies, and *S. equinum*, are serious pests in certain districts, but these species, fortunately, are more restricted in their range. More exact knowledge on this subject is a desideratum.



## CLASSIFICATION.

The British species of *Simulium* fall readily into two groups, which may be defined as follows :—

GROUP A.—Tibiae of the front and middle legs with a large patch of silvery-grey dusting on the front or outer side ; legs and abdomen with very fine hair-like pubescence ; thorax and abdomen of the male usually with silvery markings ; last three abdominal segments of the female shining ; front tarsi more or less thickened ; halteres always light yellow ; male genital claspers flattened dorso-ventrally.

GROUP B.—Tibiae without any silvery-grey dusting ; if the front tibiae sometimes appear silvery, this is owing to the colour of the pubescence ; legs and abdomen more or less densely clothed with a coarse close-lying pubescence, which is almost scale-like and usually yellowish or golden ; thorax and abdomen of the male without silvery markings ; abdominal integument of the female entirely dull ; front tarsi not at all thickened ; halteres often dark ; male genital claspers diverse in form, but never flattened dorso-ventrally and usually roundish in section.

## GROUP A.

*Table of males.*

1. Hind tibiae and metatarsi conspicuously pale on the basal half	..	..	2
Hind tibiae pale only at the extreme base, if at all	..	..	3
2. Front metatarsi about $6\frac{1}{2}$ times as long as broad	..	..	<i>ornatum</i>
Front metatarsi about 5 times as long as broad	..	..	<i>variiegatum</i>
3. Hind metatarsi mainly dark and more or less thickened	..	..	4
Hind metatarsi largely pale and not at all thickened	..	..	<i>argyreatum</i>
4. Middle tibiae conspicuously yellowish or silvery on the basal third or half	..	..	<i>reptans</i>
Middle tibiae entirely or almost entirely black (for distinctions between these three species see figures of genitalia)	..	<i>tuberosum, morsitans, austeni</i>	

*Table of females.*

1. Frons greyish, dull	..	..	2
Frons blackish, shining	..	..	3
2. Fore and mid femora darkened on the apical half	..	..	<i>ornatum</i>
Fore and mid femora entirely or almost entirely yellow	..	..	<i>variiegatum</i>
3. Face dull greyish	..	..	4
Face shining blackish like the frons	..	..	<i>tuberosum</i>
4. Thorax somewhat shining, with scarcely a trace of silvery-grey lateral patches towards the front	..	..	<i>argyreatum</i>
Thorax scarcely shining, with coarser pubescence and fairly distinct silvery-grey lateral patches towards the front	..	..	5
5. Pale markings of legs sharply defined ; hind metatarsi clear yellow on the basal half	..	..	<i>reptans</i>
Pale markings of legs less sharply defined ; basal half of hind metatarsus more smoky yellow	..	..	6
6. Abdomen distinctly yellow at the base*	..	..	<i>morsitans</i>
Abdomen not yellow at the base*	..	..	<i>austeni</i>

\* This is only a doubtful distinction, as I have seen only one female which can with any reasonable certainty be associated with the males described as *S. austeni*.

1. *Simulium ornatum*, Mg. (figs. 1, 2, 3 and 4).

*Length*, 2·5–4·5 mm.

*Male*.—Antennae all black, as in every other British species. *Thorax* velvet-black (as in all the species of this group), clothed uniformly and fairly densely with a short, close-lying golden pubescence; in front with a pair of shimmering silvery spots, narrowly or broadly separated in the middle; about half only of these spots reflects light at one time; in certain lights the side and hind margins of the mesonotum are also silvery. Pleurae with a patch of soft hairs between the prothoracic spiracle and the base of the wing, on the area called by Malloch the “membranous patch.” These hairs, though very easily rubbed off, provide an important specific character, as there are only two other British species which possess them. *Abdomen* velvet-black, with the silvery lateral spots on segments 2, 6 and 7 as usual in this group. The long hair on the “basal scale” varies in colour from yellow to black; long hair is also present along the sides. *Genitalia* (fig. 1, *a*): basal lobe of side-pieces short, the claspers long, strap-shaped, slightly curved, of even width throughout, with a single short spine near the tip on the inner edge. Adminiculum broad, thumb-like. Little or no variation appears to occur in the genitalia of this species; about 15 specimens were carefully mounted and compared. *Legs*: front pair black, the tibiae silvery on the outside; femora clothed rather densely with long black hair, and a few rather long hairs at the tips of the tarsal joints, which are moderately flattened and expanded. Middle and hind legs dark brown to blackish, the basal quarter of the femora, basal third or half of the tibiae, base of the mid metatarsi and basal half or three-fifths of the hind metatarsi, brownish yellow. Hind metatarsus (fig. 4, *a*) nearly as broad as the tibia.

*Female*.—*Head* entirely dull silvery-grey; antennae black, the two basal joints usually, but not always reddish. *Thorax* dull greenish black, with fine golden pubescence as in the male; in front with large silvery grey lateral patches, which are only narrowly interrupted by ground-colour in the middle, and include a dull black transverse stripe, which when viewed from behind becomes silvery, while the silvery parts become blackish. Pleurae with the same patch of soft hair as in the male. *Abdomen* with the long hair on the basal segment yellowish; second segment black above, silvery grey at the sides; segments 3–5 dull black in the middle, with whitish patches posteriorly on the membranous sides, bare; segments 6–8 shining, with rather sparse fine yellowish hair. *Legs* much as in the male, but the enlargement of the front tarsi (fig. 3, *a*) is rather more noticeable, the hind metatarsi are much less thickened, the front femora are scarcely hairy, and the pale markings, especially of the middle and hind tibiae, are more extensive; the ground colour of the front tibiae dark; occasionally the front and middle femora are largely pale, though they are always darkened at least at the tips. All the coxae dark. Claws (fig. 2, *a*) with a distinct tooth near the base.

*Time of appearance*.—The dates of capture of the specimens I have examined range more or less continuously from 13th March to 20th August, though the great majority were taken during April and May. Stray specimens have also been taken in October, and even (in the Channel Islands) at Christmas.

*Distribution*.—*S. ornatum* is probably common everywhere, wherever running water is available, though apparently it is less common towards the north. I have



the following records :—ENGLAND : Padstow, Cornwall (*L.*) ; Taunton (*Miss B. K. Taylor*) ; Wells, Somerset (*L.*) ; New Forest (*H., S., V., Y.*) ; Crowborough, Sussex (*J.*) ; Lee, Kent (*V.*) ; Weybridge, Surrey (*V.*) ; Wilton (*J.*) ; Netheravon (*Capt. E. P. Argyle*) ; Burnham Beeches (*E.*) ; Felden and Bricket Wood, Herts. (*P.*) ; Bath (*Dr. A. Lutz*) ; Crickleigh, Gos. (*R. Newstead*) ; Cambridge (*J.*) ; Whittlesford, Cambs. (*L.*) ; Newmarket (*V.*) ; Ampton, West Stow and Tuddenham, Suffolk (*N.*) ; Colwick Park, Staffs. (*V.*) ; Oxford (*H.*) ; Sherwood Forest and West Leake, Notts. (*Cr., Y.*) ; Burley in Wharfedale (*G.*). WALES : Porthcawl and Llangammarch Wells (*Y.*). SCOTLAND : Kilmarnock (*K.*) ; Braidwood, Lanarks. (*K.*) ; Bonhill, Dumbarton (*K.*) ; Hawkhead, Renfrew (*K.*) ; Edinburgh (*Ct., G.*) ; Nethy Bridge, Inverness (*K.*) ; Logie, Elgin (*J.*) ; Loch Assynt, Sutherland (*Y.*). IRELAND : Clare Island (*G.*).

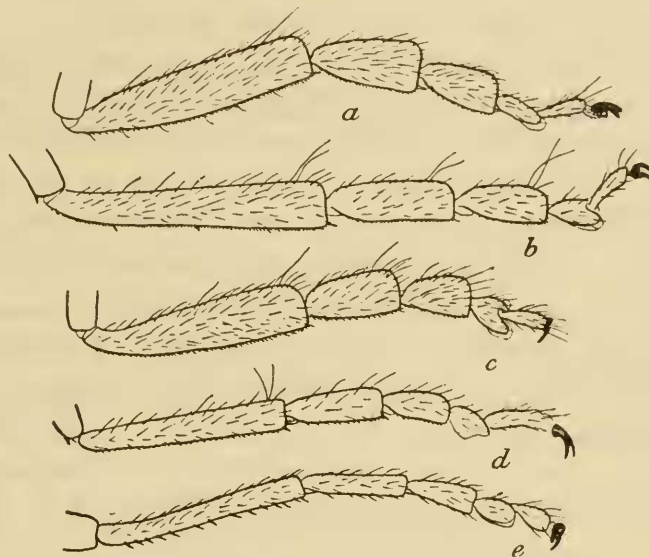


Fig. 3. Front tarsi of female, British *Simulium*. All  $\times 40$ . *a*, *S. ornatum* ; *b*, *S. variegatum* ; *c*, *S. reptans* ; *d*, *S. equinum* ; *e*, *S. subexcisum*.

*Habits.*—As previously mentioned, it is doubtful whether this species is a blood-sucker, the only record suggesting that it may be so being a note on a specimen collected by Capt. E. P. Argyle to the effect that it was found on a pony's side. Prof. J. W. Carr found numbers of females flying in a swarm, some of the members of which were biting, but as the swarm also contained *S. argyreatum* and *S. equinum*, it is probable that these species were the offenders. Mr. F. Jenkinson has also observed (at Wilton) a large swarm composed of females of this species and *S. equinum*. Prof. R. Newstead has made some interesting observations on the habits of this species. He says (*Ann. Trop. Med.*, i, p. 40) : "Occasionally the insects were seen completely immersed in the water, where they seemed at perfect ease either when walking along the stems of the plants or cleaning their legs and antennae. In such cases the wings were folded partly round the abdomen, so that they tapered to a point behind, and in this way were seen to form a large air cavity. This remarkable trait was observed in still water only."

*Synonymy.*—There can be no doubt that this is the species described by Meigen, though *Culex sericeus* of Linnaeus may be an older name for it ; at any rate Meigen's description of *S. sericea* almost certainly indicates *S. ornatum*, rather than *S. reptans*,



under which it is sunk in the Catalogue of Palaearctic Diptera. I also consider that *S. auricoma* and *S. fasciata* of Meigen, and *S. crassitarsis* of Macquart are really only *S. ornatum*, though *S. auricoma* appears as a synonym of *S. latipes* in the Palaearctic Catalogue. Curtis' *S. trifasciatum* is undoubtedly a synonym, and Macquart's *S. tibiale* and *S. vernum* may perhaps be others. Lundström, believing the genitalia to be variable, described the species as a variety of *S. reptans*, but the two are perfectly distinct, even Meigen having appreciated some of the differences between them.

## 2. *Simulium variegatum*, Mg. (figs. 1, 3).

Closely allied to *S. ornatum*, but differs in the following particulars:—Front tarsi (fig. 3, *b*) in both sexes markedly longer and thinner; no sign of soft hairs on the pleurae between the prothoracic stigma and the base of the wing; male genitalia (ten specimens compared) with the adminiculum (fig. 1, *b*) rather smaller; legs of female much paler, the front coxae and femora being entirely yellow, and usually the middle femora also, though sometimes these are somewhat darkened towards their tips; the ground colour of the front tibiae is yellow, except on the apical fourth. These differences, though for the most part slight, are I believe constant.

*Time of appearance*.—From 18th April to 20th September.

*Distribution*.—SCOTLAND: Gorge of Avon, nr. Hamilton, Lanarks. (*K.*); Cleghorn, Lanarks. (*K.*); Bonhill, Dumbarton (*K.*); Forres (*K.*); Kirkcudbright (*K.*); Comrie and Blairgowrie, Perth (*Ct.*); Nethy Bridge, Spey Bridge, Aviemore, Kincaird, Dunachton and Corrou, Inverness (*K.*, *Y.*, and *G.*); Logie, Elgin (*J.*); Dingwall, Cromarty (*K.*, *Y.*); Loch Assynt, Sutherland (*Y.*). IRELAND: Cappoquin, Co. Waterford (*K.*); Wexford (*K.*); Newcastle, Co. Down (*K.*). ENGLAND: Aysgarth Force (*G.*).

From the above list of localities it would seem that this species is confined to comparatively high altitudes, where it to a large extent replaces *S. ornatum*.

*Synonymy*.—As Meigen lays stress on the yellow femora I think the species must be correctly identified, though it has not been properly distinguished before. The Palaearctic Catalogue places *S. variegatum* as a synonym of *S. reptans*, but I cannot accept this, as I have not seen a single specimen of *S. reptans* with yellow femora. *S. varium*, Mg., would seem from the description to be *S. variegatum*. Zetterstedt describes it as *S. ornatum* var. *b*, but I think the structural difference in the front tarsi is sufficient to entitle it to specific rank. There is a correctly named specimen in the old British Museum collection, and other specimens in the Stephens collection over the manuscript names *affinis* and *luteicornis*; though these names were listed by Stephens in his catalogue, no description was ever published.

## 3. *Simulium reptans*, L. (figs. 1, 3, 4).

*Length*, 2·3–3 mm.

*Male*.—*Thorax* with the silvery markings rather smaller, more rounded and decidedly more brilliant than in *S. ornatum*, and with the golden pubescence much more scanty. Pleurae without the patch of hairs in front of the wing-base. *Abdomen* much as in *S. ornatum*, but less hairy; the hair on the basal scale black. *Genitalia* (about a dozen mounts compared; fig. 1, *c*): claspers of slightly different shape from

those of *S. ornatum*, being somewhat narrowed towards the tip; external part of adminiculum much longer and narrower, and its internal appendages of different form. *Legs* black, with the following exceptions: front tibiae with the usual silvery-grey patch; middle tibiae yellowish on the basal half, with a silvery sheen, especially on the outer side; hind tibiae pale on the extreme base; hind metatarsi brownish on the basal half or two-thirds. Front tarsi considerably expanded, more so than in *S. variegatum*; hind metatarsi (fig. 4, c) only slightly enlarged, their diameter being considerably less than that of the tibiae. Front femora not so hairy as those of *S. ornatum*.

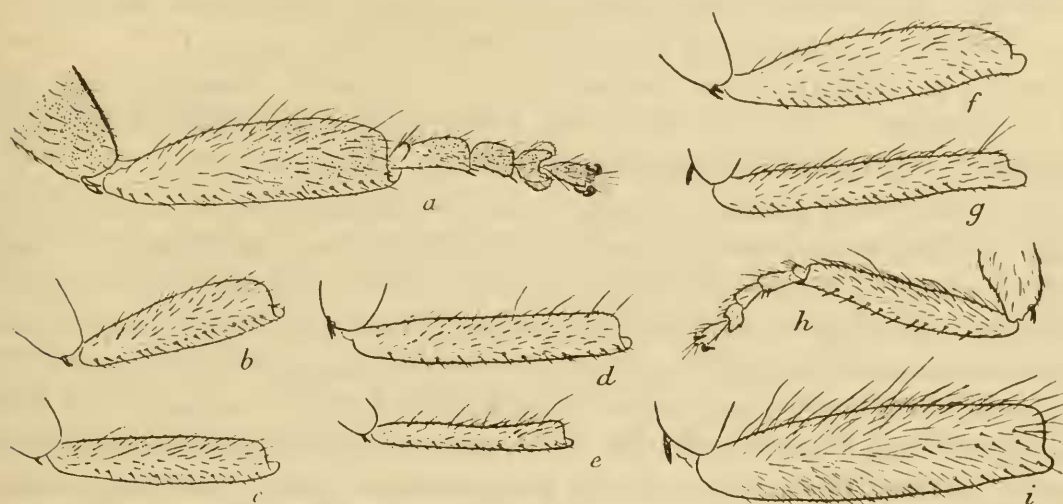


Fig. 4. Hind tarsi or metatarsal joints of *Simulium*,  $\times 40$ :—a, *S. ornatum*,  $\delta$ ; b, *S. tuberosum*,  $\delta$ ; c, *S. reptans*,  $\delta$ ; d, *S. argyreatum*,  $\delta$ ; e, *S. equinum*,  $\delta$  or  $\eta$ ; f, *S. latipes*,  $\delta$ ; g, *S. latipes*,  $\eta$ ; h, *S. angustipes*,  $\delta$  from Nairn; i, *S. hirtipes*.

*Female*.—*Head*: face with silvery-grey dusting, frons and vertex polished black. Antennae black, the two basal joints often indistinctly reddish. *Thorax* dull greenish black with large patches of silvery-grey dusting on the shoulders, more conspicuous in certain lights; these patches however are not distinctly divided by transverse stripes as they are in *S. ornatum*; the whole mesonotum clothed with fine hair-like golden pubescence, more densely so than in the male. Pleurae lacking the patch of soft hairs. *Abdomen*: hair on basal segment yellow; second segment more or less yellowish, silvery-grey at the sides; segments 3–5 dull black, bare; segments 6–8 shining blackish, with fine yellowish hair. *Legs*: front pair with the coxae clear yellow; femora almost entirely blackish brown; tibiae yellow, black on the apical fourth, the usual patch of silvery-grey dusting present, but less conspicuous on account of the yellow ground-colour; tarsi (fig. 3, c) black, very much expanded, considerably more so than in the male. Middle and hind legs: coxae black; femora blackish, except at the extreme base; tibiae clear yellow on the basal half or two-thirds, black at the apex; tarsi blackish, base of mid metatarsus yellowish-brown, hind metatarsus clear yellow on the basal half or two-thirds. All the claws simple, though with well-marked basal enlargement.



*Time of Appearance.*—Though the dates of which I have records range from 20th May to 28th August the principal months are June and July. It is considerably later in making its appearance than *S. ornatum*, but apparently does not remain on the wing so long.

*Distribution.*—So far as these islands are concerned, *S. reptans* appears to be almost entirely a Scotch insect, a fact which has already been noted by Austen in his *British Blood-sucking Flies*. The following are the localities from which I have examined specimens:—SCOTLAND: Loch Assynt and Lochinver, Sutherland (Y.); Dingwall and Loch Maree, Cromarty (K.); Nethy Bridge, Spey Bridge, Corroul, Dunachton, Kincaig and Aviemore, Inverness (G., J., K., L., Y.); Ballater, Aberdeen (J.); Logie, Forres and Brodie, Elgin (J., K., Y.); Kinlochewe, Ross (W. R. O. Grant); Aberfoyle, Comrie and Rannoch, Perth (Ct., G.); Lewis I. (L.); Hawkhead, Renfrew (K.); Gorge of Avon, Lanarks. (K.). ENGLAND: Bassenthwaite, Cumberland (T. Hartley). IRELAND: Kenmare, Kerry (K.); Cappoquin, Waterford (K.); Newcastle, Co. Down (K.); Louisburgh, Co. Mayo (M.).

*Habits.*—As is well known, this species is a troublesome blood-sucker. According to Colonel Yerbury (quoted by Austen, *British Blood-sucking Flies*), it “occurs in countless numbers in the Abernethy forest in June and July, and causes great annoyance. A sweep or two with the butterfly net round one’s head results in a perfect holocaust of victims.” Colonel Yerbury in his paper, *The Diptera of Wester Ross*, records it as very troublesome at Lochinver, flying in company with *Hydrotaea irritans* and biting his forehead. Mr. T. Hartley, in sending specimens to the British Museum for identification, describes it as “a terrible pest to man, dogs and cattle at Bassenthwaite.” As regards the males, Colonel Yerbury has found them on flowers of yellow saxifrage at Loch Assynt.

*Synonymy.*—Although doubt might arise as to the interpretation of Linnaeus’ *S. reptans* it is beyond question that this is the species so regarded by Meigen and Zetterstedt. Beyond this I think the names *S. elegans*, Mg., *S. posticata*, Mg., and *S. nana*, Zett., probably apply to the same species, while there is nothing in the original description of *S. argyreata*, Mg., to separate it definitely from *S. reptans*. Lundström figures the species under the name *Melusina reptans* var. *rostrata*.

#### 4. *Simulium morsitans*, sp. n. (fig. 1).

Differs from *S. reptans* as follows:—*Male*: middle tibiae only inconspicuously, and hind metatarsi scarcely perceptibly pale at the base, the latter a little more enlarged. Claspers (fig. 1, *d*) much broader, slightly broadening out at the tip, apical spine absent; adminiculum of quite a different form, somewhat resembling that of *S. ornatum* and *S. variegatum*. *Female*: yellow markings of legs rather less conspicuous, the hind metatarsi especially being only brownish yellow on the basal half.

The species is distinguished mainly by the characters of the male genitalia; these organs were mounted and compared in three out of the four males examined, and their structure appeared to be constant. Too much reliance cannot be placed on the coloration.

*Type* ♂ in the British Museum, from Christchurch, Hants., 23.v.1897 (Y.).

*Time of appearance.*—Most of the specimens examined were taken during May or early June, but other dates are 21st April, 11th July and 13th August.



*Distribution*.—This seems to be the representative in the South of England of the more northerly *S. reptans*, though it also occurs in Scotland, but apparently rarely. ENGLAND: New Forest (V., Y.); Christchurch (Y.); Lymington (Dr. L. W. Sambon); Enslow, Oxfordshire (H.); Cambridge (J., females only); Fakenham, Suffolk (N., females only). SCOTLAND: Aviemore (K., the male figured).

*Habits*.—Colonel Yerbury notes: "This fly bites and annoys one in the forest."

*Synonymy*.—Although it is possible that one of the older names may apply to this species, it is impossible to be certain, and it therefore seems wisest to propose a new name. The species is referred to (but not named) by Austen in his *British Blood-sucking Flies*, though an examination of the series on which his remarks were based shows that though all the females are *S. morsitans*, all but one of the males are *S. austeni*.

##### 5. *Simulium austeni*, sp. n. (fig. 1, f).

Differs from *S. reptans* as follows:—Male legs entirely dark blackish-brown, except for the silvery patch on the front tibiae. Claspers (fig. 1, f) rather longer and of a slightly different shape, and provided near the base on the inner edge with an inwardly projecting thumb-like process (this does not show up well in the figure; it is best seen in an oblique side-view); adminiculum and its appendages practically the same as in *S. morsitans*. Female (if correctly identified in a single specimen from Barnham) with the pale markings rather less distinct even than in *S. morsitans*.

The difference in the form of the male claspers is quite sufficient to distinguish *S. austeni* specifically from *S. morsitans*. About 8 mounts of the genitalia were compared, and many others examined in the dry state. There was no observable variation. Possibly when more females are discovered better characters can be adduced for the separation of that sex from *S. reptans* and *S. morsitans*.

*Type* ♂ in the British Museum, from Rugby, 23.iv.1893 (E. E. Austen).

*Time of appearance*.—The dates of capture of the specimens examined range only from 23rd April to 22nd May.

*Distribution*.—ENGLAND: West Moors, Dorset (Y.); Rugby (E. E. Austen); Shotover and Lye Hill, Oxford (H.); Cambridge (J.); Barnham, Suffolk (N.); Felten, Herts. (P.).

*Habits*.—Austen found the males "dancing in a swarm in the afternoon by a gate in a field."

*Synonymy*.—The same remarks apply to this species as to *S. morsitans*. I at first confused it with *S. tuberosum*, but the two are really quite distinct.

##### 6. *S. tuberosum*, Lndst. (figs. 1, 2, 4).

Differs from *S. reptans* as follows:—*Male*: legs entirely black; hind metatarsus (fig. 4, b) considerably more thickened; no distinct silvery-grey margin to the mesonotum, though the shoulder-spots are well-marked. Genital claspers (three mounts compared; fig. 1, e) resembling those of *S. austeni*, but more slender and slightly widened towards the tip; the internally projecting thumb-like process near the base well developed, but not so broad as in *S. austeni*; adminiculum with its ventral portion very short and broad, its internal appendages smaller and less complicated than in

other members of this group. *Female*: face polished black, like the frons; antennae all black; thorax without any trace of silvery grey shoulder-patches; abdomen entirely black, the tergites of segments 6–8 rather smaller and less noticeably shining; legs black, except that the front tibiae have the usual silvery patch, and the bases of the entirely middle and hind tibiae are rather indistinctly brownish yellow; the front tarsi not quite so much expanded as in *S. reptans*.

Apart from the above distinctions, *S. tuberosum* seems to be consistently though only slightly smaller than *S. reptans*.

*Time of appearance*.—Dates range from 14th May to 14th August, while a few females were also taken on 13th November.

*Distribution*.—This is another purely northern or mountain species. SCOTLAND: Loch Maree, Ross (*K.*); Loch Assynt, Sutherland (*Y.*); Dingwall, Cromarty (*K.*); Kincaig, Nethy Bridge and Aviemore, Inverness (*G., K., Y.*); Ardochy, Invergarry, Inverness (*E. C. Ellice*). ENGLAND: Bassenthwaite, Cumberland (*T. Hartley*).

*Habits*.—Mr. T. Hartley has sent specimens of this species to the British Museum, together with those of *S. reptans*, with the information that they were “a terrible pest to man, dogs and cattle.” He also writes (June 1913) that “it is only within the last three years that it has been troublesome, but now is becoming a perfect plague.” Similarly Mr. E. C. Ellice writes that it is “locally known as ‘the Black Fly.’ It is a pest, and from being almost unknown—I think quite unknown—30 or 40 years ago, has increased year by year in the district.” In this connection it may be significant that there are no specimens in any of the old collections in the British Museum.

*Synonymy*.—Through the kindness of Dr. R. Frey, of Helsingfors, I have been able to examine one of the late Prof. Lundström’s original specimens, which agrees in every respect with ours, so that the identification is beyond doubt. Some of the British Museum specimens were determined by M. Roubaud as *S. nigrum*, Mg., but I cannot follow this. Meigen drew up his description from two males, and, inadequate though it is, the absence in it of any reference to silvery markings on the thorax, must I think definitely exclude the present species.

## 7. *Simulium argyreatum*, Mg. (Lndst.). (figs. 1, 2, 4).

*Length*, 2·2–3 mm.

*Male*.—Silvery markings of *thorax* more crescent-shaped and rather less distinct than in the four species last considered; in some specimens they are produced backwards as two greyish lines as far as the posterior greyish border of the mesonotum, and in those specimens the mesonotum might be described as greyish with three broad velvet-black stripes. The pubescence of the mesonotum is so very short and fine that it is scarcely visible under a hand-lens, though in the specimens with the grey-striped thorax it seems to be a little more noticeable; this may be due merely to the larger size of these specimens. Pleurae with a small patch of soft hair between the prothoracic stigma and the wing-base (at least in some specimens). *Abdomen* velvet-black with the usual silvery-grey side-spots on segments 2, 5 and 6; the hair on the basal segment black. *Genitalia* (three mounts compared; fig. 1, *g*) very characteristic, the claspers short, squarish, and provided with 5 or 6 short spines along



their terminal edge, instead of only one (these do not show in the figure). *Legs* black, except for the silvery patch on the front tibiae, and the hind metatarsi, which are dull yellowish, except at the tip and the extreme base. Front femora with only a little short hair; front tarsi slightly expanded; hind metatarsi almost cylindrical (fig. 4, *d*).

*Female*.—*Head*: frons and vertex shining black; face silvery grey; antennae all black. *Thorax* with integument of mesonotum somewhat shining, with a sub-metallic greenish hue, and clothed with a very fine yellowish pubescence, finer than in the other species of this group; viewed from in front the thorax has indications of two rather broad greyish stripes which are somewhat divergent posteriorly, but there are no shimmering grey shoulder patches. *Pleurae* with a small patch of hairs as in the male; these hairs are less conspicuous than in *S. ornatum* or *S. equinum*. *Abdomen* black, second segment silvery grey at the sides; hair on basal segment yellowish; tergites of last three segments very large and markedly shining (thus distinguishing it from the female of *S. tuberosum*, with which it might perhaps be confused). *Legs*: front pair black, the coxae and the tibial patch conspicuously silvery grey, the tarsi about as much enlarged as in *S. reptans*. Middle and hind legs black, the femora and tibiae more or less reddish towards the base; the hind metatarsi yellowish, except for the tip, the extreme base, and a line along the under side. Claws (fig. 2, *b*) all simple, as in *S. reptans*.

*Time of appearance*.—This seems to be a spring species, common in April, May and early June, and appearing again in August. One specimen in the British Museum series was taken on 1st November.

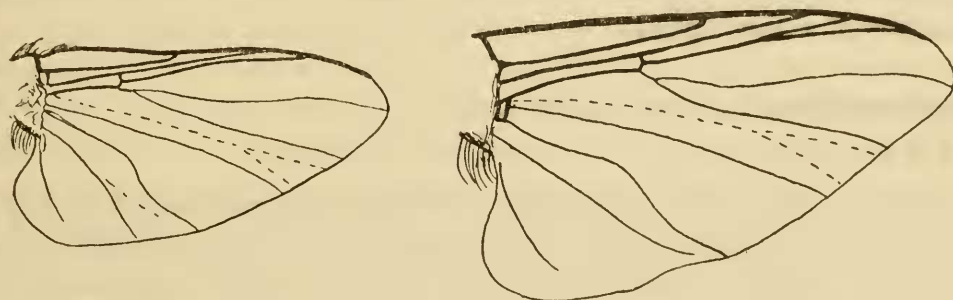


Fig. 5. Wings of *Simulium*,  $\times 13$ ; left: *S. latipes*; right: *S. hirtipes*.

*Distribution*.—Essentially a lowland species, with its headquarters apparently in East Anglia. ENGLAND: Bourne End, Bucks., and Felden, Herts. (*P.*); Sandy, Beds. (*E.*); Cambridge (*J.*); Newmarket and Chippenham, Cambs. (*V.*); Barton Mills, Bungay, Suffolk (*V.*); and Brandon (*M.*), Ampton, Fakenham and West Stow, Suffolk (*N.*); Wood Walton Fen, Hunts. (*E.*); Sherwood Forest and West Leake, Notts. (*Cr.*). SCOTLAND: Bonhill and Helensburgh, Dumbarton (*K.*).

*Habits*.—This is evidently an habitual blood-sucking species. The writer was besieged by a large swarm of females on Sandy Heath, many attempting to bite and some actually doing so. Mr. J. C. F. Fryer informs me that it is very troublesome in spring and again in August on Wood Walton Fen and also at Wicken. In these localities it is worthy of note that there is no running water anywhere in the neighbourhood.



*Synonymy*.—Although I consider it very doubtful whether this is really Meigen's *S. argyreatum*, I have followed Lundström in so interpreting it, as I am not acquainted with another available name. The species stood in Mr. Verrall's collection as *S. nigrum*, Mg., and so it may possibly be, but I prefer to leave this name a *nomen dubium*. *S. nanum*, Zett., is given as a synonym of *S. argyreatum* in the Palaearctic Catalogue, but I believe it is more likely to be a small *S. reptans*. The specimens recorded by Verrall as *S. nanum* from Tuddenham are apparently small examples of this species, in which the legs are paler than usual. From the description I very much suspect Meigen's *S. sericatum* may be this species, though in the Palaearctic Catalogue it appears as a synonym of *S. ornatum*.

## GROUP B.

*Table of Species.*

1. Pubescence distinctly deep or light golden ; second hind tarsal joint with deep excision .. .. .	2
Pubescence whitish or dull yellowish ; second hind tarsal joint entire or emarginate .. .. .	4
2. Hind metatarsi largely pale .. .. .	<i>equinum</i>
Hind metatarsi entirely dark .. .. .	3
3. Hind metatarsi of male much enlarged ; femora and tibiae of female more or less uniformly dark .. .. .	<i>latipes</i>
Hind metatarsi of male not enlarged ; femora and tibiae of female yellow with black tips .. .. .	<i>aureum, angustipes</i>
4. Radial sector of wings simple .. .. .	<i>subexcisum</i>
Radial sector of wings forked .. .. .	<i>hirtipes</i>

8. ***Simulium equinum***, L. (figs. 1, 2, 3, 4, 6).

*Length*, 2.5–3.5 mm.

*Male*.—*Thorax* velvet-black, the margins of the mesonotum more or less greyish, but without any silvery sheen ; pale golden pubescence on the shoulders and in front of the scutellum (possibly perfect specimens may have the mesonotum uniformly clothed with this pubescence). *Pleurae* with a well-marked patch of hair between the prothoracic stigma and the wing-base. *Abdomen* velvet-black, with yellowish hair. *Genitalia* (fig. 1, *h*) with the side-pieces large ; claspers small, thin, curved, projecting internally when at rest. *Legs* black ; knees of the middle and hind legs narrowly yellowish ; hind metatarsi (fig. 4, *e*) mainly yellow on the basal half, almost cylindrical ; front tarsi quite thin, the metatarsi cylindrical ; femora and tibiae, especially of the front legs, with a coarse pale golden pubescence. *Halteres* yellow.

*Female*.—*Head* dull grey, sparsely clothed with coarse pale golden pubescence ; antennae dark brown, the two basal joints reddish. *Thorax* light or dark grey with three narrow but rather ill-defined blackish longitudinal lines, the lateral pair convergent anteriorly, and also immediately before the scutellum ; in very dark specimens these lines are obsolete, in very light ones an additional and broader pair appear at the sides of the mesonotum. The whole dorsum of the thorax is clothed with coarse pale golden pubescence, which is, however, very easily rubbed off. *Pleurae* with the patch of hair as in the male. *Abdomen* black (in dried specimens), rather

densely clothed with a similar pubescence to that of the thorax; there is however even in perfect specimens a narrow transverse bare band at the base of each segment. *Legs* (fig. 3, *d*, front tarsus) as in the male, but sometimes with the femora and tibiae much more extensively pale towards the base. Claws (fig. 2, *e*) much larger in proportion to the size of the insect than in any other species of the genus; they are quite simple and not very much enlarged at the base; as if to compensate for the enlarged claws, the empodia are reduced in size. *Halteres* yellow.

*Time of appearance*.—Continuously from early March till September; one specimen in the British Museum was captured on 28th October.

*Distribution*.—A common species in many districts in the South of England; less common in the north, and apparently unknown in Scotland. I have examined specimens from the following localities: ENGLAND: Padstow, Cornwall (*L.*); Taunton (*Miss B. K. Taylor*); Wareham, Arne and Wimborne, Dorset (*Y., M.*); Christchurch, Lymington and Brockenhurst, Hants. (*J., K., L., V., Y.*); Darenth, Kent (*V.*); Oxshott, Surrey (*H. Donisthorpe*); Weybridge (*V.*); Felden and Bricket Wood, Herts. (*P.*); Barton Mills, Suffolk (*V.*), Ampton, Barnham, Icklingham, Timworth and West Stow, Suffolk (*N.*); Eynsham, Norfolk (*V.*); Oxford (*H.*); Attenborough, Beeston, Clifton, Edwinstowe, Gotham, Radcliffe and West Leake, Notts. (*Cr., Y.*); Netheravon, Wilts. (*Capt. E. P. Argyle*); Wilton (*J.*); Grimshill, Salop. (*L.*); Burley in Wharfedale (*G.*); Holmes Chapel, Cheshire (*A. E. Cameron*); Great Salkeld, Cumberland (*H. Britten*). WALES: Llandrindod Wells (*E. Brunetti*). IRELAND: Killaloe, Co. Clare (*M.*); Cappoquin, Co. Waterford (*K.*).

*Habits*.—This fly is a blood-sucker, and seems to have a partiality for horses. Specimens were sent to the British Museum at different times by Colonel L. J. Blenkinsop and Captain E. P. Argyle as having been taken on horses' ears. The former observer wrote that "these flies are troubling horses here [near Salisbury and near Christchurch] by sucking blood from their ears and causing ulceration." Outside Britain its habits appear to be the same; Captain C. E. P. Fowler has found it in Morocco "swarming around gardens and marsh outside Fez; attacks horses about ears." *S. hippovororum*, Malloch, from Mexico, which is probably a near ally of this species, has been recorded as having the same habit. *S. equinum* also attacks man; Mr. Hamm has observed that it bites quite severely. The females have more than once been taken flying in company with those of *S. ornatum* (*vide* notes under the latter species).

Mr. H. Britten\* has observed the oviposition of this species. He noticed the females enter the water and deposit eggs actually on the submerged parts of plants. This habit appears to be unusual, as it has not been recorded for any other species; it may possibly be correlated with the unusually large claws.

*Synonymy*.—From the apparently definite connection of this species with horses, I think it may be safely considered to be Linnaeus' *Culex equinus*, which has always been assumed to be a species of *Simulium*, while his short description corresponds better with this species than with any other. Linnaeus simply describes the thorax as black, with greyish sides (*i.e.* pleurae, presumably); as already mentioned, specimens with a blackish mesonotum are not uncommon, and in these the three stripes

\* Ent. Mo. Mag., May, 1915.



are indistinct; the mention by Linnaeus of the head being white above and below the eyes, together with the legs being black, will definitely exclude all the species of our Group A. Zetterstedt suggested that *C. equinus* might be the same as *S. fuscipes*, Fries (which is undoubtedly the species now under consideration), though he does not say he had noticed any connection between *S. fuscipes* and horses, merely remarking: "Femina fortiter mordens."

The species is listed in the Palaearctic Catalogue and in Verrall's List of British Diptera as *S. maculatum*, Mg., and this is probably correct, in spite of the fact that Meigen described the abdomen as spotted with black, which is not the case in dry specimens. Of the other names which are commonly placed as synonyms of *S. maculatum*, *S. fuscipes*, Fries, *S. marginatum*, Mg., and *S. pubiventris*, Zett., are doubtless correctly so given; but whatever *S. columbaschense*, Fabr., and *S. lineatum*, Mg., may be, they are certainly not this species, the former having pale tibiae and tarsi, and the latter having the "hinterleib braun, hinten glanzend," and the "schiene alle weisschillernd." Macquart's *S. pubescens* and *S. cinereum* are in all probability our *S. equinum*. Some of the specimens in the British Museum collection have been determined by Verrall and Roubaud as *S. lineatum*, Mg. Lundström determined the species as *S. aureum*, Fries, but I feel sure he was wrong in this, since if the hind metatarsi had been pale in Fries' specimens, that author would almost certainly have mentioned the fact.

#### 9. *Simulium latipes*, Mg. (figs. 1, 2, 4, 5).

*Length*, 2·3–3·5 mm.

*Male*.—*Thorax* velvet-black, more or less densely clothed with golden pubescence. Pleurae bare. *Abdomen* velvet-black, with yellowish hair on the basal segment. *Genitalia* (fig. 1, *m*): side-pieces large; claspers also large, and with a peculiar twist, the apical part (bearing as usual one short spine) being truncate and bent inwards (the figure is taken from a mounted specimen, about a dozen of which have been compared); in a dry specimen the tip of the clasper is usually not visible in a ventral view. *Legs* dark brown, tarsi blackish; the integument uniform in colour, though the front tibiae often appear silvery and the base of the middle and hind tibiae golden-yellow, owing to the colour of the pubescence; the long hairs, which are fairly numerous on the hind legs, are dark; hind metatarsi (fig. 4, *f*) very much flattened, their diameter usually about as great as that of the tibia, though there is some variation in this respect. *Wings* as in the figure (fig. 5, *a*), the venation being the same as that of all the other British species, with the exception of *S. hirtipes*. *Halteres* brownish yellow.

*Female*.—*Head* grey, with golden pubescence; antennae black with the two basal joints reddish. *Thorax* blackish grey, in perfect specimens densely clothed with coarse bright golden pubescence; pleurae bare. *Abdomen* equally densely clothed with similar pubescence; the integument usually dark, but sometimes reddish, except for the small tergal plates which remain dark. *Legs*: femora and tibiae dark brown, more or less distinctly paler towards the base, the middle and hind tibiae in the lightest specimens with a dark ring at or near the base; pubescence golden. Tarsi black; the hind metatarsi (fig. 4, *g*) sometimes brownish, very little thickened. Claws (fig. 2, *c*) with a large blunt tooth projecting from the base. *Halteres* lighter than in the male.



*Time of appearance.*—From early April till the beginning of September, but commonest apparently in April and May.

*Distribution.*—This is probably the commonest species of the genus all over the British Islands, though it may often be overlooked. The following list includes most of the localities from which I have examined specimens, but I have not kept a note of all:—ENGLAND: Helston, Padstow and Donderry, Cornwall (*L.*, *V.*, *Y.*); Bovisand, S. Devon (*Y.*); New Forest (*Y.*); Corfe Castle, Dorset (*Y.*); Cusop, Hereford (*Y.*); Stokenchurch, Oxford (*V.*); Oxford (*H.*); Crowborough, Sussex (*J.*); Burnham Beeches and Fulmer, Bucks. (*E.*); Harrow Weald and Ruislip, Middlesex (*E.*); Ampton, Livermere and Timworth, Suffolk (*N.*); Orford, Suffolk (*K.*); Kirtling, Cambs. (*V.*); Cambridge (*J.*); Burley in Wharfedale (*G.*). WALES: Porthcawl, Glamorgan (*Y.*). SCOTLAND: Glencorse and Blackford Hill, Edinburgh (*G.*, *J.* *Waterston*); Hunter's Quay and Ardentinnny, Argyll (*K.*); Arrochar, Bonhill, Helensburgh and Luss, Dumbarton (*K.*); Braidwood and Gorge of Avon, Lanarks. (*K.*); Hawkhead, Renfrew (*K.*); Dalry, Ayr (*K.*); Auchenbowie, Stirling (*J.*); Aberfoyle, Blairgowrie, Loch Gill and Loch Tay, Perth (*Ct.*); Benbecula (*N. B. Kinnear*); Aberdour, Aberdeen (*G.*); Aviemore, Ballindalloch, Corroul, Dunachton, Kincaig, Nethy Bridge, Newtonmore and Spey Bridge, Inverness (*G.*, *J.*, *L.*, *Y.*); Nairn (*Y.*); Logie, Elgin (*J.*); Kinlochewe, Ross (*W. R. O. Grant*); Dingwall, Cromarty (*K.*); Loch Maree (*K.*); Loch Assynt, Sutherland (*Y.*). IRELAND: Sligo (*K.*); Newcastle, Co. Down (*K.*); Cappoquin, Co. Waterford (*K.*).

*Habits.*—Nothing has been recorded, except that Colonel Yerbury has found the males hovering in a flock in the shade. In view of the commonness and wide distribution of the species, the absence of any records of its biting would seem to prove that it is not a blood-sucker.

*Synonymy.*—This has always been assumed to be Meigen's *S. latipes*, and I see no particular reason to doubt that it is so. *S. aureum*, Fries, has often been quoted as a synonym, but I believe wrongly; the same applies to *S. auricoma*, Mg., which appears to me from the description to be *S. ornatum*.

#### 10. *Simulium aureum*, Fries, (fig. 1, *i*).

Differs from *S. latipes* as follows:—Hind metatarsi thin in both sexes; male genital claspers (fig. 1, *i*) much thinner and not twisted; adminiculum differently constructed (four mounts compared); femora and tibiae of female yellow with black tips; of the male somewhat lighter towards the base.

*Time of appearance.*—The dates of capture of the small number of specimens I have seen range from 31st March to 15th August.

*Distribution.*—Apparently a rare species, occurring with *S. latipes*, to which it is closely allied. In the following list of localities those only are given from which I have seen male specimens, as I know of no reliable character to distinguish the females from those of *S. latipes* or *S. angustipes*. ENGLAND: Mildenhall, Suffolk (*Y.*); Foxhall, nr. Ipswich (*M.*); Cambridge, in house (*J.*). WALES: Porthcawl, Glamorgan (*Y.*).

*Habits.*—Probably identical with those of *S. latipes*.

*Synonymy.*—I think this species must be correctly named, as it fits Fries' description very well indeed. It is evident that *S. aureum* has been wrongly sunk under *S. latipes*;

Fries himself recognised the affinity of the two species, but called attention to the difference in the size of the hind metatarsi of the male. Lundström, through a mistaken interpretation of Fries' species, and through not having recognised the females of either, has redescribed the true *S. aureum* as *S. angustitarsis*. Meigen's *S. rufipes* may be another synonym, but even if that is so Fries' name takes precedence. A female in Stephens' collection under the manuscript name *flavipes* seems to belong to this species.

#### 11. *Simulium angustipes*, sp. n. (figs. 1, 4).

Differs from *S. latipes* as follows:—Hind metatarsi (fig. 4, *h*) thin in both sexes; middle and hind tibiae of the male with the integument more or less distinctly yellow at the base; female legs rather paler, especially on the front tibiae; male genitalia (fig. 1, *j*, *k*, *l*) different, the claspers much smaller and usually with a somewhat hammer-shaped tip; adminiculum somewhat hairy and though variable in size quite different in form from that of *S. latipes* or *S. aureum*; *appendices superae* much larger and very conspicuous in a dry specimen.

Like the last, this is a near ally of *S. latipes*, differing from it principally in the male genitalia, the structure of which, especially as regards the *appendices superae*, is not unlike what is figured by Lundström as *S. pallipes*, Fries. It is the only British species in which I have seen any appreciable variation in the genitalia. The adminiculum is always hairy, but though very thin in the Barton Mills specimens, it is a good deal thicker in most of the others, including those figured. The claspers, though usually with a small projecting hump at the tip, are quite simple at the tip in specimens from Crowborough and Logie, as well as being a little shorter and thicker than usual. The *appendices superae* are also somewhat variable in shape and in the number of hairs they carry. None of these variations however seem to be sufficiently definite to be regarded as of specific value, and none of them make any approach towards *S. aureum* or *S. latipes*.

In general characters also there is some variation; in the specimens from Nairn, Cambridge and Crowborough the middle and hind tibiae are not any paler at the base; while in those from Padstow, Logie and Sligo the hind metatarsus is distinctly thicker than usual, though much less expanded than in *S. latipes*.

*Type* ♂ in the British Museum from Barton Mills, 3. v. 1909 (*C.*).

*Time of appearance*.—March to October.

*Distribution*.—Like *S. aureum*, this seems to be mainly a lowland or coast species, often associated with *S. latipes*. ENGLAND: Padstow, Cornwall (*L.*); Wells, Somerset (*L.*); Crowborough, Sussex (*J.*); Cambridge (*J.*); Barton Mills, Suffolk (*C.*); Walton-on-Naze, Essex (*Y.*). SCOTLAND: Nairn (*K.*); Logie, Elgin (*J.*). IRELAND: Sligo (*K.*).

*Habits*.—Probably similar to those of *S. latipes*. Colonel Yerbury notes that he found the males hovering in twos and threes in the shade.

*Synonymy*.—As this species is not included by Lundström in his account of the Finnish species, it is not likely that it is the true *S. aureum*, Fries, and that being so there appears to be no old name available for it. There is a specimen in the old Clifton collection in the British Museum labelled *S. sericeum*.



12. *Simulium subexcisum*, sp. n. (figs. 1, 2, 3, 6).

*Length*, 2.2–3 mm.

*Male*.—*Thorax* velvet-black, with yellowish, not deep golden pubescence (in the two specimens examined the mesonotum was much denuded); scutellum with yellowish hair which is longer than usual. Pleurae bare. *Abdomen* velvet-black, hair on the basal segment yellowish. *Genitalia* (two mounts compared: fig. 1, *n*): side-pieces large; claspers roundish in section, tapering towards the tip, somewhat curved, with a single short spine at the tip; adminiculum as in the figure. *Legs* uniformly blackish, with coarse yellowish pubescence, except on the tarsi; front femora and hind femora and tibiae with long dark hair, which is denser on the hind tibiae than in any other British species except *S. hirtipes* (one of the specimens is denuded). Front tarsi thin, cylindrical; hind metatarsi distinctly thickened, though not so much so as in *S. latipes*. Second hind tarsal joint (fig. 6, *c*) with only an irregular emargination at the base, not a definite excision as in the eleven preceding species. *Wings* with normal venation. *Halteres* blackish.

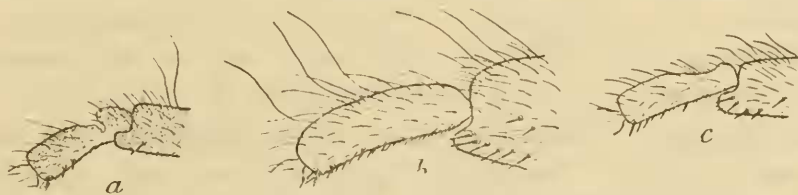


Fig. 6. Tip of metatarsus and whole of second tarsal joint of :  
*a*, *Simulium equinum*; *b*, *S. hirtipes*; *c*, *S. subexcisum*;  
 × 60.

*Female*.—*Head* clothed with coarse yellowish pubescence; face yellowish grey; frons greyish below, darker and slightly shining above, narrower than in the other species. Antennae all black. *Thorax* dull blackish-grey, the mesonotum densely clothed with coarse pubescence, which is sometimes uniformly yellowish, sometimes however showing three broad longitudinal stripes of dark brown.\* *Abdomen* dark, densely clothed with coarse yellowish pubescence. *Legs* (fig. 3, *e*, front tarsus) entirely dark brownish-black; less hairy than in the male; hind metatarsi not thickened; second hind tarsal joint as in the male; claws (fig. 2, *f*) much resembling those of *S. latipes* and its allies. *Halteres* yellow.

*Type* ♂ in the Cambridge Museum, from Crowborough, Sussex, 9.iv.1904 (*J.*).

*Time of appearance*.—April to June.

*Distribution*.—Though widely distributed, apparently a rare species, as I have not seen more than four specimens from any one locality. ENGLAND: New Forest (*D. Sharp*, *Y.*); Crowborough, Sussex (*J.*); Harrow Weald, Middlesex (*E.*); Tarrington, Hereford (*Y.*). SCOTLAND: Aviemore, Dunachton and Nethy Bridge (*G.*, *Y.*); Nairn (*Y.*); The Mound, Sutherland (*Y.*).

*Habits*.—Nothing recorded.

\* It is possible that these two forms of the female may represent distinct species, but there are no structural differences.

*Synonymy*.—The male genitalia bear a rather close resemblance to Lundström's *S. lyra* and *S. annulus*, but the agreement is not complete, and as he stated that he could detect no external difference between his species and *S. latipes*, I think it best to regard our species as previously undescribed. Examples of Lundström's species kindly given me by Dr. Frey unfortunately both lacked the hind tarsi, which, apart from the genitalia, carry the most important specific distinctions.

13. **Simulium hirtipes**, Fries, (figs. 1, 4, 5, 6).

*Length*, 3–4·5 mm.

*Male*.—*Thorax* dull blackish, the mesonotum clothed rather densely with coarse yellowish pubescence; long yellow hair on the scutellum and the posterior part of the mesonotum. *Abdomen* dull black, with long dark hair on the basal segment and on the venter, short yellowish hair on the tergites. *Genitalia* (fig. 1, *o*): the claspers differ from those of all the other British species in having two short spines at the tip (one clasper in the specimen figured was abnormal in having three such spines). *Legs* uniformly dark, the femora and tibiae clothed with yellowish hair, which on the hind legs is very long and dense; hair on tarsi darker. Joints of front tarsi cylindrical, but the metatarsus not so long as in *S. latipes*. Hind metatarsi (fig. 4, *i*) very much thickened, in diameter about equal to the tibiae; only a very indistinct projection on the inner side at the tip. Second hind tarsal joint (fig. 6, *b*) simple, no sign of basal excision or emargination. *Wings* (fig. 5, *b*) with a slight brownish tinge, the radial sector forked, and a minute "basal cell" present (these two characters, like those of the hind tarsi, differentiating *S. hirtipes* from all the others in the British fauna). *Halteres* black.

*Female*.—Head, thorax and abdomen dull blackish-grey, with pale yellowish pubescence. *Legs* entirely dark; yellowish pubescence, but few or no long hairs, on the femora and tibiae; hind tibiae and metatarsi, especially the latter, much more slender than in the male; second hind tarsal joint as in the male. Claws simple, resembling those of *S. reptans*. *Wings* as in the male. *Halteres* dark brown.

*Time of appearance*.—May to July.

*Distribution*.—Another purely northern species, of which I have the following records:—SCOTLAND: Blairgowrie and Dunkeld, Perth (*Ct.*, *Y.*); Aviemore, Ballindalloch and Nethy Bridge, Inverness (*G.*, *K.*, *L.*, *Y.*); Braemar, Aberdeen (*V.*); Dingwall and Loch Maree, Cromarty (*K.*); Loch Assynt, Sutherland (*Y.*).

*Habits*.—Colonel Yerbury (quoted by Austen, *British Blood-sucking Flies*) has observed the blood-sucking habits of this species at Dunkeld.

*Synonymy*.—There is little to remark, except that although Fries' figure does not show the forked radius, the species is without doubt correctly identified. A specimen exists in Stephens' collection with the manuscript name *picipes*.